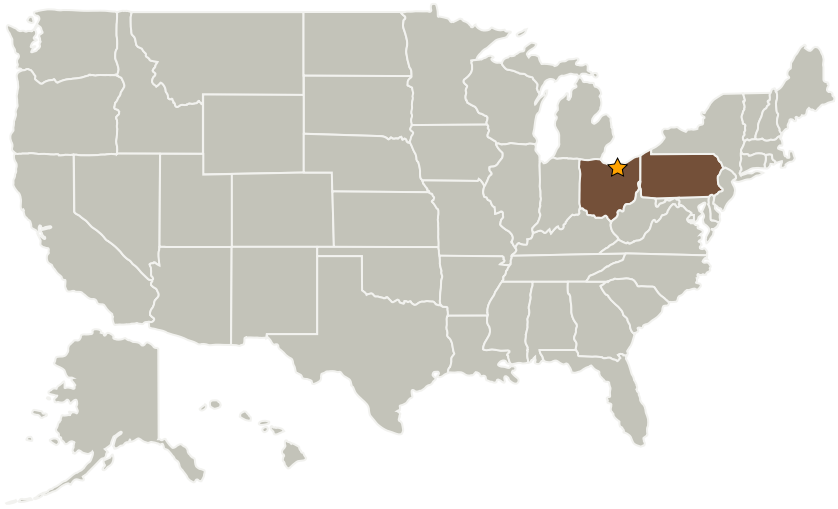
Turbulent Scalar Transport Model Validation for High Speed Propulsive Flows, Phase I

Completed Technology Project (2008 - 2008)

Project Introduction

This effort entails the validation of a RANS turbulent scalar transport model (SFM) for high speed propulsive flows, using new experimental data sets and accompanying large-eddy simulation (LES) solutions. The SFM has been used to predict local values of the turbulent Prandtl and Schmidt numbers and also provides the rms scalar fluctuation values that are used with assumed PDF models for turbulent combustion. Performing the experimental work in unison with LES studies ensures that the two sets of data will be fully compatible, and may be used to support SFM model validation. Work to date indicates some deficiencies in the present SFM model for high speed mixing problems where the two streams have very different densities, which we will attempt to resolve in this program. PIV data for the transverse injection of hot air and helium/nitrogen mixtures into a Mach 3.5 stream will be obtained in unison with LES studies to yield scalar fluctuation data not readily obtained in experiments. SFM upgrades will be performed using this unified data. Experiments will be performed by Dr. Seiner and coworkers at U. Miss using a new 12"x12" trisonic tunnel and existing slot/round jet injector models.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
CRAFT Tech - Combustion Research and Flow Technology	Supporting Organization	Industry	Pipersville, Pennsylvania

Primary U.S. Work Locations	
Ohio	Pennsylvania

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

William Calhoon

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.4 Vehicle Systems
    - TX09.4.5 Modeling and Simulation for EDL